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CANADA / NOVA SCOTIA ACID RAIN REDUCTION AGREEMENT

Nova Scotia Department of the Environment

Report on the Year Ending 31 March 1990

May 1990

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1.0 INTRODUCTION

1.1 Background

In Canada, concern for environmental damage resulting from persistent exposure to acid deposition came with a recognition of the importance of transboundary flows of airborne pollutants. Sulphur dioxide (SO₂) has been identified as a major contributor to acid deposition in Canada, generated primarily from the refining and smelting of metals and from the burning of fossil fuels, but occurring largely as a result of the transboundary flow of SO₂ from the United States.

In view of the growing awareness and concern for air quality problems, both nationally and internationally, Canada is taking a leadership role in the development of policies, legislation and programs to address air quality issues. The Canada/Nova Scotia Acid Rain Agreement is one of seven agreements between Canada and the eastern provinces (seven eastern provinces include Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Newfoundland, and Prince Edward Island) aimed at developing and coordinating programs to control acid deposition by reducing emissions of SO₂. Acid deposition has not been identified as a serious problem in western Canada because of lower acid deposition loadings and a more acid resistant environment.

In February of 1985, a Federal/Provincial Environment Ministers Agreement was made to apportion the SO₂ emissions by province in an effort to decrease acid deposition in Canada. Nova Scotia has a target to reduce total SO₂ emissions to no more than 204,000 tonnes per year by 31 December, 1994. With 1980 emissions of 219,000 tonnes used as the base year for reduction targets, Nova Scotia has agreed to reduce emissions by 15,000 tonnes. A summary of the provincial SO₂ emission targets is contained in Table 1.

The provincial programs developed to meet the 1994 SO₂ emission objectives have been targeted at reducing SO₂ emissions primarily from non-ferrous smelting and thermal power generation.

Nitrogen oxide (NO_x) emissions also contribute to the acidity of precipitation, but to a much lesser extent than sulphur dioxide. Canada is putting in place strong NO_x emission controls to improve urban air quality and address concerns about ground level ozone and acid rain. The initiatives and programs currently being developed and implemented both federally and provincially are discussed in Chapter 5.

1.2 Scope

This report is the third annual review of Nova Scotia's initiatives in support of the Canada/Nova Scotia Acid Rain Reduction Agreement. In addition to discussing SO₂ emissions and potential impacts, the report will comment on new developments and initiatives to address other emerging air quality issues.

TABLE 1
SUMMARY OF PROVINCIAL SO₂ EMISSION TARGETS
tonnes

Province	1980 base year	1994 Provincial Objective
Manitoba	738,000	550,000
Ontario	2,194,000	885,000
Quebec	1,085,000	600,000
New Brunswick	215,000	185,000
Nova Scotia	219,000	204,000
Prince Edward Island	6,000	5,000
Newfoundland	59,000	45,000
Total	4,516,000	2,474,000

2.0 EMISSIONS OVERVIEW

2.1 Nova Scotia

In Nova Scotia, emissions of SO₂ from the combustion of fossil fuels in the 1980 base case adopted by the Canadian Environment Ministers was 219,000 tonnes. Preliminary estimates of SO₂ emissions for Nova Scotia show that power generation accounts for approximately 80 percent of the SO₂ emissions in Nova Scotia. The other emission sources of significance include residential, commercial, and industrial fuel combustion which accounts for approximately 7 percent and industrial process emissions which accounts for approximately 12 percent. Transportation accounts for approximately one percent of the provincial SO₂ emissions.

All the eastern provinces have been assisting the Federal Government in the development of estimates of SO₂ emissions. The Nova Scotia Department of the Environment will continue working with Industry and the provincial Department of Mines & Energy to produce annual SO₂ emissions inventories for the province. Since 1980, industrial modernization programs have resulted in significant reductions in sulphur emissions. Projected SO₂ emissions for the year 1994 are given in Table 2 and show that Nova Scotia will be able to meet and exceed its commitment to reduce SO₂ emissions to 204,000 tonnes.

To meet the 1994 SO₂ emission objective for Nova Scotia of 204,000 tonnes, the Nova Scotia Power Corporation was given a limit for SO₂ emissions in 1994 of 160,000 tonnes. The Nova Scotia Power Corporation has developed a program to meet the 160,000 tonne objective which includes reductions at existing as well as new plants. In 1989, 146,000 tonnes of SO₂ were emitted from power generating stations in Nova Scotia. Projected emissions to the year 1994 indicate that Nova Scotia Power Corporation will be at approximately the same level of SO₂ emission as in 1989, despite a projected 25 percent increase in production. Reductions in SO₂ will result from the burning of low sulphur coal and the installation of circulating fluidized bed generating units.

The Nova Scotia Power Corporation plans to burn low sulphur coal at the existing Trenton Unit No. 5 as well as at the new Trenton Unit No. 6 scheduled to come on the system in 1992. This will reduce the sulphur dioxide emissions per unit of power generation from the Trenton Generating Station.

A 165 MW unit proposed for Point Aconi, Cape Breton, recently went through a provincial Environment Assessment Review. The unit proposes using circulating fluidized bed (CFB) combustion technology to achieve removal of 90 percent of the potential SO₂ emissions. Coal with the

highest sulphur content will supply the new CFB unit where sulphur removal efficiency is the highest, allowing the lower sulphur coals to form the blended fuels that supply other existing stations.

During 1989, the Nova Scotia Power Corporation began studying the retrofit potential for SO₂ reduction processes at several stations. The primary focus of this feasibility study is on desulfurization using a Wet Limestone Process and a Limestone Slurry Injection Process.

2.2 Canada

In Eastern Canada (i.e. seven eastern provinces), nearly 60 percent of the total SO₂ emissions come from non-ferrous smelters. Electrical utilities account for approximately 16 percent of SO₂ emissions. The Canadian Acid Rain Control Program focusses on reducing emissions from these major sources through the development of emission reduction targets. Figure 1 compares the major sources of SO₂ emissions for Nova Scotia with those for all of eastern Canada.

Different types of pollution sources require different types of controls. Sulphur dioxide emissions from coal fired generating stations can be controlled by scrubbing and by substitution of low sulphur and washed coal for high sulphur coal. These technologies are currently being utilized and/or proposed within the provincial programs to reduce SO₂ emissions.

Sulphur dioxide emissions from metal smelters can be controlled by scrubbers or by the use of acid gas technology which converts SO₂ into sulphuric acid with subsequent capture and removal. New smelters in Canada are achieving better than 95 percent sulphur capture and removal.

In the eastern United States, the relative contribution of various sources to the total SO₂ emissions differs from eastern Canada. Electrical utilities account for 74 percent of the SO₂ emissions and smelters account for only one percent. The fact that airborne pollutants are transboundary means that solving the acid rain problem in Canada requires action by the United States.

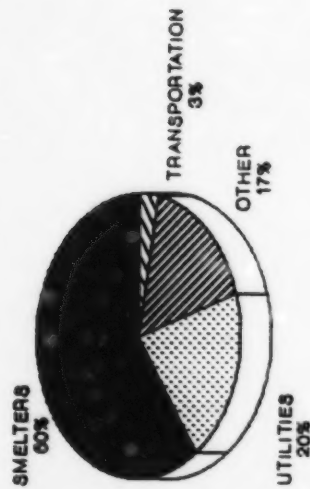
Canada has been pressing for commitment from the United States to establish its own emission reduction targets and schedules. The recent approval of new Clean Air Legislation by the United States Senate suggests that controls may soon be implemented to reduce sulphur dioxide in the United States. The new legislation, which still requires approval from Congress, contains amendments to the Clean Air Act which include programs to control acid deposition through reductions in annual emissions of SO₂ of 10 million tonnes from 1980 emission levels. Under the proposed amendments, sulphur dioxide emissions would be reduced by approximately 50 percent of the 1980 emission levels by the year 2000. Given that more than half of the acid deposition in Eastern Canada comes from the United States, a 50 percent reduction in emissions will reduce the transboundary flow of SO₂ into Eastern Canada by at least 25 percent. The proposed amendments also encourage energy conservation, use of renewable and clean alternative technologies, and pollution prevention as a long-range strategy for reducing air pollution and other adverse impacts of energy production and use.

TABLE 2
SO₂ EMISSIONS INVENTORY FOR NOVA SCOTIA
tonnes

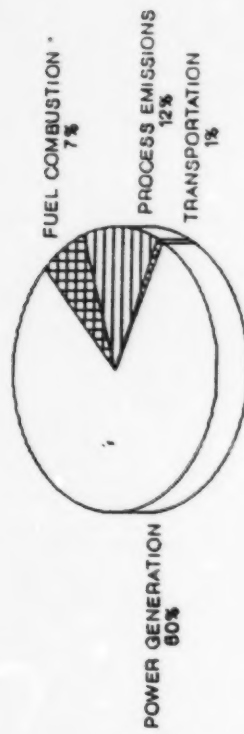
SOURCE	1980 Base line	1994 Projected
Power Generation	--	146,000*
Fuel Combustion (excluding power generation)	--	15,100*
Process Emissions		
- Oil and Gas Refining	--	14,100*
- Other Industrial	--	12,400*
Transportation	--	1,600*
Total	219,000	189,200*

* = Preliminary Estimate

EASTERN CANADIAN SO2 EMISSIONS BY SOURCE (1987)



NOVA SCOTIA SO2 EMISSIONS BY SOURCE (1987-89)



(* Excluding Power Generation)

FIGURE 1 - EMISSIONS GRAPHIC

3.0 AMBIENT AIR QUALITY IN NOVA SCOTIA

In Nova Scotia, the ambient air quality objectives under the Canada Clean Air Act have been adopted. Under this Act, three ranges of air quality objectives are established: desirable, acceptable, and tolerable. These objectives focus on preventing harm to public health. The "desirable" range which is most stringent, represents long-term goals for pollution control levels. The "acceptable" range represents long-term goals for the protection of human health. The "tolerable" range which is least stringent, represents a level of protection from immediate danger to public health.

The Nova Scotia Department of the Environment has an ambient air quality monitoring program to measure and compare ambient air quality in Nova Scotia with the Federal objectives. With respect to SO₂, monitoring is carried out in four regions of the province: Halifax-Dartmouth, Port Hawkesbury, Pictou, and Sydney-Glace Bay. For the Halifax-Dartmouth, Pictou and Sydney-Glace Bay areas, SO₂ levels are consistently within the "desirable" range. For the Port Hawkesbury area, SO₂ levels are usually within the "acceptable" range.

The Nova Scotia Department of the Environment will continue to monitor and report on ambient air quality in the province to ensure air quality remains at levels required for good health and aesthetic enjoyment.

The ambient air quality objectives that are established for SO₂ do not fully address the problem of acid rain, in which environmental damage results from cumulative deposition and is a function of the sensitivity of the environment. However, SO₂ emission reductions offer potential improvements to ambient air quality while controlling acid deposition.

4.0 ACID DEPOSITION

4.1 Field Studies

Acid precipitation collectors continue to be maintained at New Ross, Jackson (Collingwood Fish Culture Station), East River St Marys, and Cape North in the highlands of Cape Breton, in addition to the Federal station at Kejimikujik National Park. The station at Yarmouth was closed in 1989 because of difficulties encountered in data collection. The deposition trend for the federal station at Kejimikujik will provide adequate estimates for the Yarmouth area (cf. Figure 2 of the report of 30 June 1989).

Deposition of sulfate for 1988 at Kejimikujik and Jackson was 14.0 and 11.5 kg/ha respectively (Vet et al, in press), and the implication is that less than 15 kg/ha was deposited on the rest of the province. Approximately 16 kg/ha fell in 1987. The acid rain control program for eastern Canada was originally designed around a critical sulphate loading of 20 kg/ha. Ongoing research work on the effects of acidic

deposition indicates that a lower deposition level of 15 kg/ha may be required to protect more sensitive waters. Over 80 percent of the lakes in Nova Scotia are classified as highly sensitive, offering little protection against acidity.

Precipitation Chemistry for 1989 has not been reported by the analytical laboratory. No estimate of sulfate deposition is therefore yet available.

Continued evaluation of remedial techniques was conducted by the Nova Scotia Department of the Environment. In one project, 30 tonnes of granulated dolomitic limestone was added through the ice in March and by helicopter in June 1989 to Bayers Lake near Halifax. This small (5.3 ha), shallow (0.8 m mean depth) lake contains $42.4 \times 10^3 \text{ m}^3$ of water, although the 0.33 km^2 watershed contributes about 7 times that capacity on an annual basis. With this annual volume, 30 tonnes of dolomitic limestone is equivalent to 101 mg/l of limestone which, in laboratory jar tests, increased pH from 4.7 to 8.0 in 111 days, following a very rapid (24 h) increase to 6.7. Results from the lake, however, did not match the jar tests, and pH never exceeded 5 in the lake during the study. Several reasons for the lack of success are proposed in the study report (Scott, 1989), and the implications for the Nova Scotia Department of the Environment are that liming will remain as an option for countering impacts of acid rain in selected waters, but presently cannot be considered as anything but experimental. This conclusion is also consistent with that of the Nova Scotia Department of Fisheries who have experienced poor results from experimental stream liming at two sites in western Nova Scotia.

5.0 EMERGING INITIATIVES AND CONTROL PROGRAMS

5.1 Nova Scotia

The Nova Scotia Department of the Environment has demonstrated continued commitment to protection of the environment with the introduction of 18 new Acts and sets of Regulations in the past three years. With a control program and schedule in place to meet the SO_2 emission objectives under the Federal/Provincial Acid Rain Reduction Agreement, new initiatives and control programs are being developed to address other air quality issues. A major initiative is creation of the Minister's Task Force on Clean Air.

Regulations have been drafted* to limit the volatility of gasoline and reduce VOC (Volatile Organic Carbon) emissions. VOC emissions combine with NO_x emissions to form ground level ozone (urban smog) in the presence of sunlight.

Nova Scotia is undertaking implementation of a vehicle inspection and maintenance program by 1992 aimed at reducing emissions from motor vehicles. Nova Scotia is also participating in a National Task Force to develop a Code of Practice for vapor recovery from Gasoline Distribution Systems.

* Regulations Respecting Gasoline Volatility were passed on 26 April 1990.

5.2 Canada

Canada is planning to implement strong NO_x and VOC emission controls to improve urban air quality and address concerns for acid rain and ground level ozone (urban smog). The Canadian Council of Ministers of the Environment has released a draft Federal/Provincial plan for the management of emissions of NO_x and VOC. The objective of the plan is to resolve existing air quality problems with particular emphasis on ground level ozone and to meet Canadian International obligations associated with these emissions. The management plan proposes 61 initiatives, including timetables for reducing emissions between now and the year 2005, with special reduction targets set for large cities. The management plan is consistent with Canada's commitment not to increase the transboundary flow of pollutants into the United States and contribute to ground level ozone and acid rain problems.

The Federal government recently announced its intention to issue a regulation that will further increase the stringency of emission standards for new motor vehicles. These standards are targeted at the proposed California standards to be phased in by the 1995 model year in California. The proposed standards would be introduced in Canada for the 1994 model year, with full compliance to be achieved in the 1995 model year.

In addition to addressing concerns for acid rain and ground level ozone, Canada recognizes that other environmental concerns such as global warming require immediate attention. The Canadian Council of Ministers of the Environment has established a steering committee to: a) develop and implement a Canadian strategy on global warming, and b) provide advice to Canada on the implications of proposed international response strategies.

Continuing cooperative and consultative approaches by Canadian governments to promote the development of integrated solutions to environmental issues will be a hallmark of the future as they are of the present.

6.0 RELATED REPORTS, PUBLICATIONS - 1989

Precipitation Chemistry in Nova Scotia: 1978 - 1987.

J.K. Underwood, J.G. Ogden III, D.H. Waller, 1989.
Water, Air, and Soil Pollution 46: 13 - 27.

Canada/Nova Scotia Acid Rain Reduction Agreement,

Nova Scotia Department of the Environment Report on the Year Ending 31 March, 1989. 11 pages.

Bayers Lake Liming Project,

R. Scott. 1989. Technical University of Nova Scotia Centre for Water Resources Studies, on contract to the Nova Scotia Department of the Environment. 36 pages. Available for review in the library of NSDOE.

7.0 REFERENCES USED

Vet, R.J., W.B. Sukloff, M.E. Still, C.S. McNair, J.B. Martin, W.F. Kobelka, and A.J. Gaudenzi, 1990.

Canadian Air and Precipitation Monitoring Network (CAPMON).

Precipitation Chemistry Data Summary, 1988. In press, Environment Canada, Atmospheric Environment Service, Downsview, Ontario.